



## Energy Efficiency trends and policies in ITALY

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## CONTENT OF THE REPORT

The report describes the energy efficiency trends and policies in Italy, focusing on energy efficiency trends based on the ODYSSEE database. The analysis focuses on the period 2000-2019, before the spread of the COVID-19 pandemic.

The report also illustrates the recent and innovative energy efficiency policies and measures, included in National Recovery and Resilience Plan (NRRP), submitted in April 2021, and National Integrated Energy and Climate Plan (PNIEC).

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## EXECUTIVE SUMMARY

In 2019 primary energy consumption was 151.5 Mtoe: the consumption has been decreasing since 2005 returning to consumption levels of the first half of the 1990s. The final energy consumption is also decreasing: in 2019 amounted to 111.2 Mtoe, -8.9% in the period 2000-2019. The corresponding energy intensities fell in the period 2000-2019: primary energy intensity decreased by 15.2% and final energy intensity by 12.5%. The trend of both energy intensities was decreasing since 2005.

The drop in the final consumption was due to decreases in energy consumption of industry (-35.3%) and transport sector (-10%). The driving sector was services sector, +36,8% of energy consumption in 2000-2019, followed by households, +12.2%.

In the period 2000-2019, all fossil fuels had important decrease in final consumption: -29.3% for oil products, -63.8% for coal and -13.0% for natural gas. Electricity consumption increased by 7.1%. The renewable energy sources had the highest growth rate in the period 2000-2019: over 300% reaching the share of 7.7% of final energy consumption in 2019. Heat consumption is also rising: +37.3% in the period 2004-2019 with a quota of 3.7% in 2019.

The energy efficiency for final consumers, as measured by ODEX, improved by 18.1% over the period 2000-2019, with an average rate of 1% per year from 2000 to 2019. In industry the energy efficiency improvement has been steady and significant: 1.6% per year over the period 2000-2019. All industrial branches contributed to the progress in energy efficiency of industry sector, more rapidly in the years 2004-2011: chemicals is the most efficient branch. The progress in transport sector has been constant (1.4% per year). The residential sector had a steady progress in energy efficiency but smaller than in 1990s caused by the changes in lifestyle and dwelling comfort: 0.6% per year over the period 2000-2019.

The National Recovery and Resilience Plan (NRRP) allocates €28 billion for energy efficiency. The interventions will be destined to buildings renovation for residential buildings (Superbonus, Ecobonus and Sismabonus), judicial buildings, schools and hospitals, and to promotion of efficient district heating system. The NRRP also includes interventions in favour of sustainable mobility through Mission 3 “Infrastructures for sustainable mobility”: investments in the railway network to enhance the transport of passengers and goods by rail.

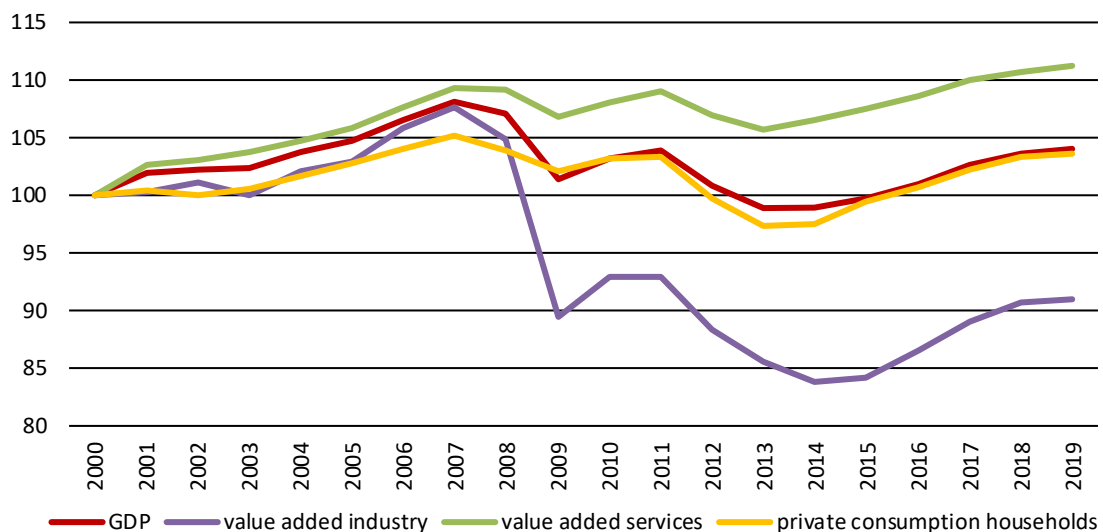
The National Integrated Energy and Climate Plan (PNIEC) sets the national targets to be achieved by 2030 for energy efficiency, renewable energy sources and reduction of CO<sub>2</sub> emissions, energy security, development and sustainable mobility. Compared to the binding cumulative energy savings target of 51.44 Mtoe, the proposed measures lead to a cumulative estimated savings of 57.44 Mtoe. 2030 target will be pursued through Obligation Scheme of White Certificates and a mix of fiscal, economic and regulatory alternative measures already active. Some of them will be reviewed and strengthened.

## 1. ECONOMIC AND ENERGY EFFICIENCY CONTEXT

### 1.1. ECONOMIC CONTEXT

In 2019, GDP amounted to 1,728 billion euros, chain-linked year 2015, with an increase of 0.9% compared to 2018. GDP has had significant drops in the years 2008-2009 and 2012-2013: only in the last years GDP led to the mid-2000s levels. All components of demand showed the same trend as GDP: constant growth in the period with large drops in the years 2008-2009 and 2012-2013, especially for value added of industry that in the period 2000-2019 decreased by 9%.

**Figure 1: Macro-economic developments in Italy (2000=100)**



Source: ODYSSEE

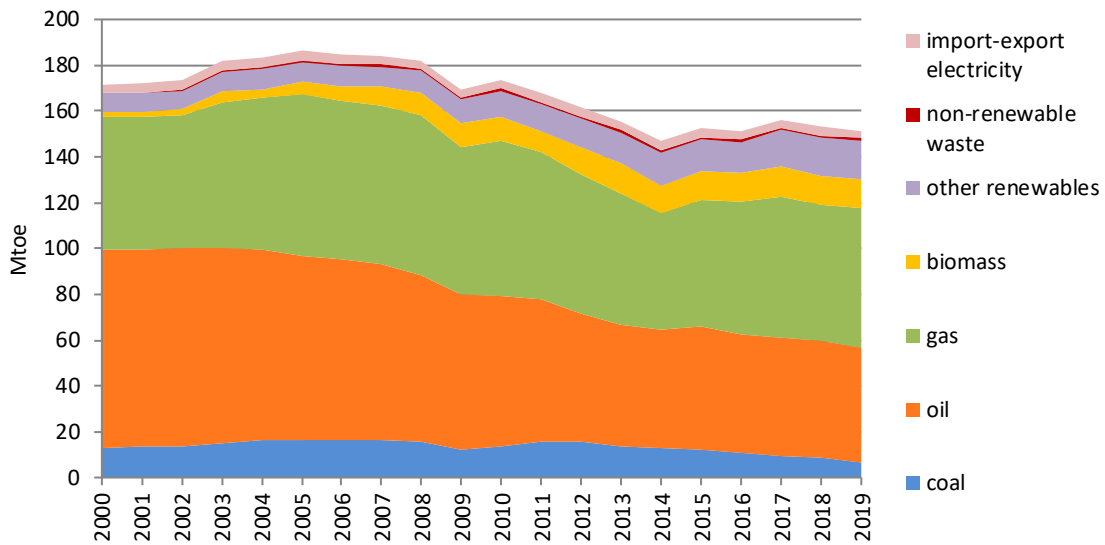
### 1.2. TOTAL ENERGY CONSUMPTION AND INTENSITIES

The total energy supply in 2019 was 151,5 Mtoe, down by 1% compared to 2018. In the last years, the energy consumption has amounted to around 150-155 Mtoe, at the levels of the early 1990s, after the constant drops following the crises of 2008 and 2011: in the period 2000-2019 the total energy supply decreased by 11.8% at an average of 0.7% per year. The energy mix is constantly developing: the share of fossil fuels has decreased by over 14 percentage points reaching 78% of total energy supply, while the consumption of renewables has almost tripled from 6% in 2000 to 19% in 2019. Natural gas is the main energy source: in 2019 consumption of natural gas was 60.9 Mtoe, +5.2% compared to 2000, followed by oil with 54.0 Mtoe, down by 42.5% in the period 2000-2019. The renewables consumption



was 29.5 Mtoe: almost 50% are biomass<sup>1</sup>, followed by geothermal energy (18.3%) and hydro energy (13.5).

**Figure 2: Total energy supply by energy source**

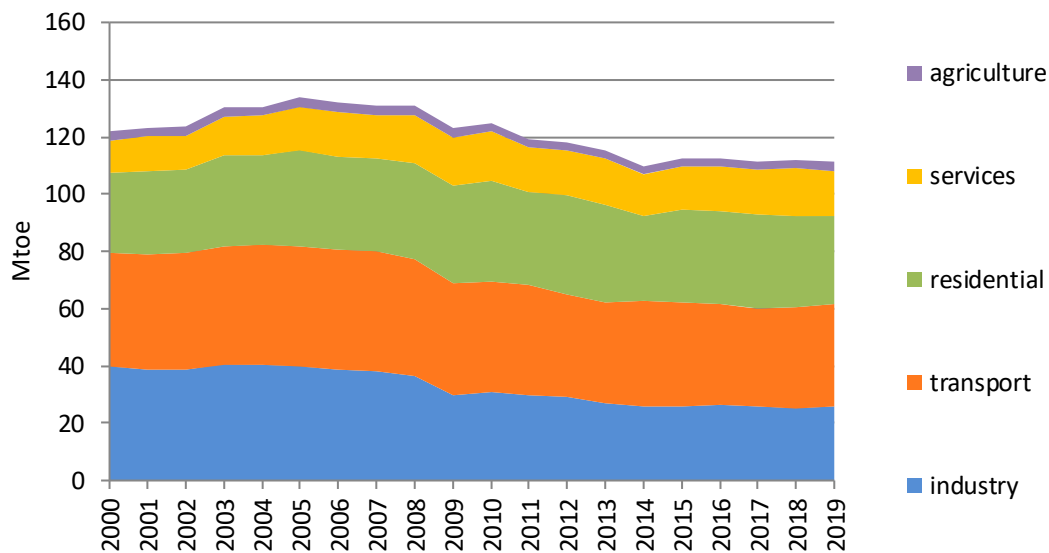


Fonte: EUROSTAT

In 2019 final energy consumption amounted to 112.1 Mtoe, down 1.0% compared to 2018: in the last years, energy consumption has fluctuated around 111-112 Mtoe. Energy consumption in Italy has returned to consumption levels of mid 90s: -8.9% in the period 2000-2019. The sectors showed constant growth until 2005, followed by reductions in energy consumption in different ways per sector. In particular, industry reduced energy consumption by 35.3% from 2005 at an average rate of -3.1% per year. In the period 2000-2019 the energy consumption in transport sector decreased by 10%: in the years 2005-2019 the drop was 14.6%. In agriculture the cut was 7.4% since 2000. In the residential sector, energy consumption increased by 12.2% in the period 2000-2019 but decreased by 8.8% from 2005. The services sector is the driving sector in the period 2000-2019: it's observed an increase value added by 11.2% and in energy consumption by 36.8% at an average rate of 1.7% per year, despite some years of drop (figure 3).

<sup>1</sup> Primary solid biofuels, charcoal, liquid biofuels and biogases

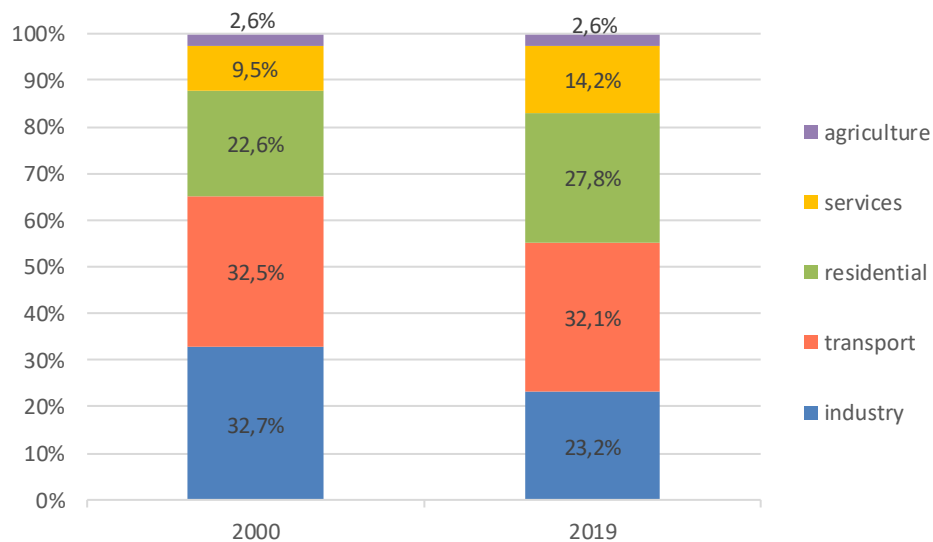
**Figure 3: Final energy consumption by sector**



Source: ODYSSEE

The energy trends of the sectors have changed the structure of final consumption (figure 4). In 2019 the transport sector has the highest energy consumption with 32.1% even if lower than 2000, followed by residential sector with 27.8%, industry with 23.2% and services with 14.2%: to highlight the drop of almost 10 percentage points in industry and the increase of about 6 and 5 percentage points in residential and services sectors, respectively.

**Figure 4: Shares of energy consumption by sector**

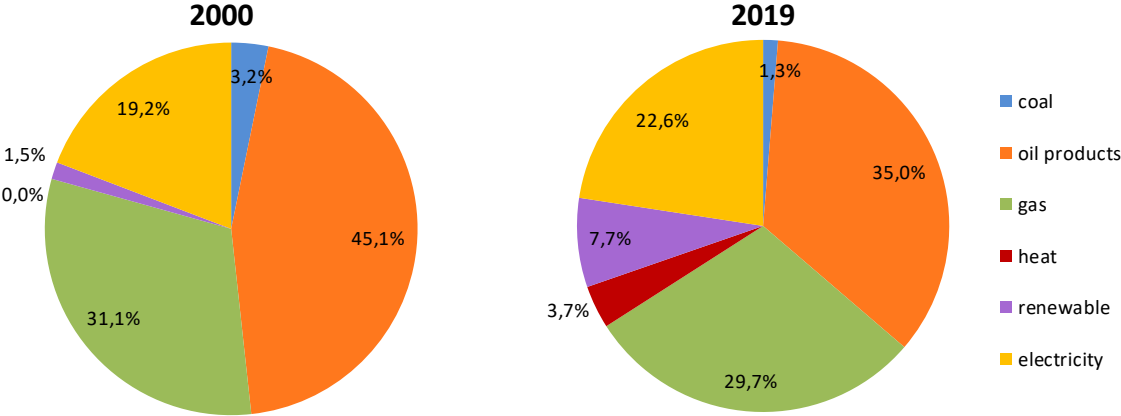


Source: ODYSSEE

In 2019 fossil fuels absorb 65.9% of final energy consumption: the share has decreased by more than 13% since 2000. In absolute terms, the final consumption of fossil fuels in 2019 was 73.3 Mtoe, -24.3%

since 2000: in particular the decrease was 63.8% for coal, 29.3% for oil products and 13.0% for gas. The contribution of electricity, renewables and heat is growing (figure 5): the final consumption of renewables, mainly primary solid biofuels, increased by over 300%, reaching 8.6 Mtoe in 2019 from 1.8 Mtoe in 2000. Electricity and heat increased in the period 2000-2019, respectively, by 7.1% and 37.3%: final consumption in 2019 was 25.1 Mtoe for electricity and 4.2 Mtoe for the heat.

**Figure 5: Shares of energy consumption by energy source**

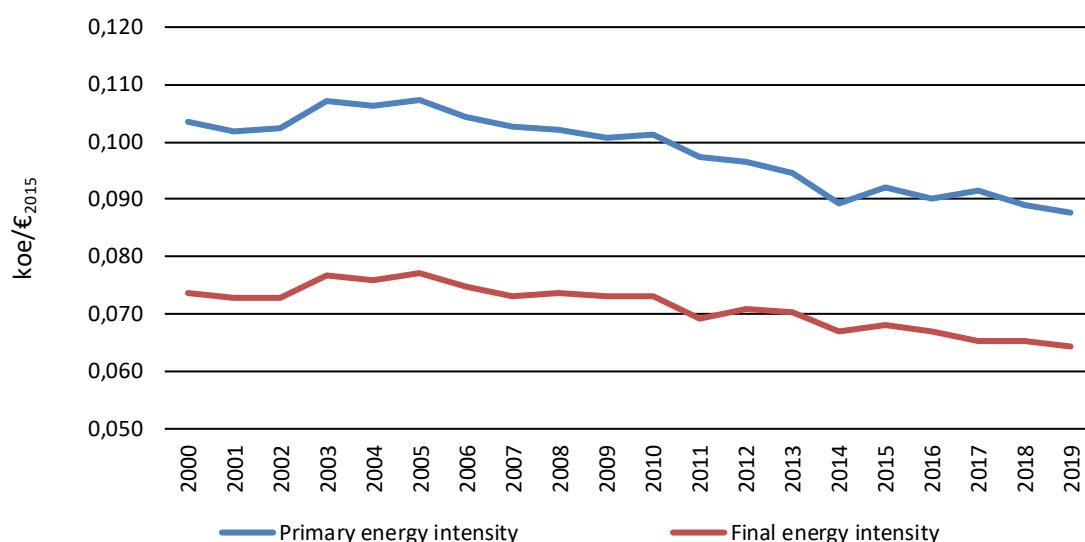


Source: ODYSSEE

In 2019 primary energy intensity, i.e. the ratio between the total energy supply and the GDP, was 0.088 koe/€<sub>2015</sub>, -1.5% compared to 2018. In the period 2000-2019, energy intensity decreased by 15.2% from 0.103 koe/€<sub>2015</sub> in 2000.

The final energy intensity, ratio between final consumption and GDP, was 0.064 koe/€<sub>2015</sub> in 2019, down by 1.4% compared to the previous year. The final intensity showed a similar trend to the primary intensity but with a slower decrease: -12.5% in the period 2000-2019 (Figure 6).

**Figure 6: Primary and final energy intensity**



Source: ODYSSEE, EUROSTAT

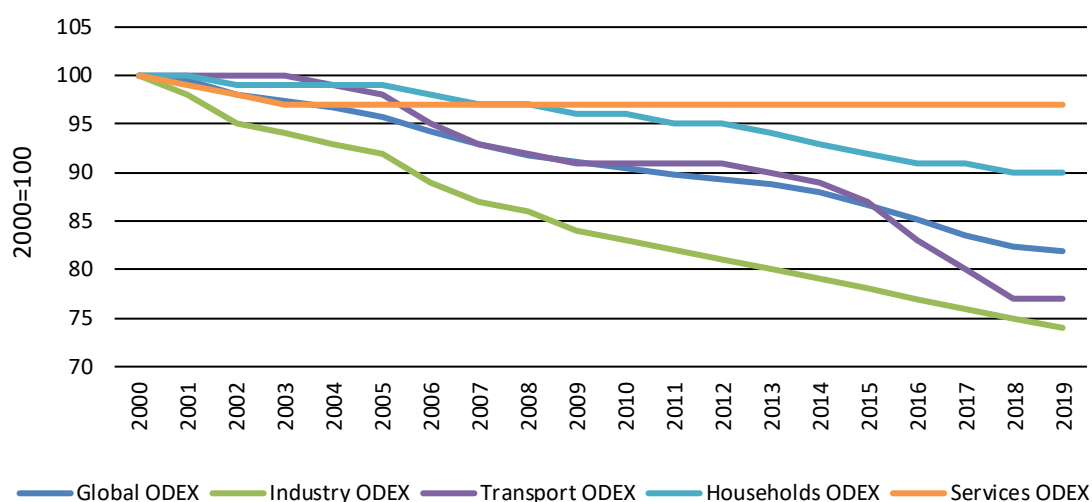
These trends are determined by a better GDP trend than energy consumption trend: GDP grew more than consumption in the years of economic expansion (2000-2007) and reduced less in the recession years (2008-2014).

The energy intensity is influenced by factors not related to energy efficiency such as structural changes, comfort effects linked to human behavior, therefore, to assess the progress in energy efficiency it's better to use the indicators based on energy unit consumption such as ODEX index. The ODEX index aggregates energy efficiency indicators at detailed levels (sub-sector, end-use, appliances) into a synthetic bottom-up energy efficiency index with weights given by their share in total final energy consumption.

The technical energy efficiency indexes are showed in figure 7: the technical energy efficiency indices are showed in Figure 7: the observed energy efficiency index is cleaned from the negative effects of equipment's less efficient use on energy efficiency not due to a worsening.

In 2019, the ODEX index for the whole economy amounted to 81.9, + 0.6% compared to 2018: since 2000, the improvement in energy efficiency has been 18.1% with a gain of 1% per year. All sectors have showed energy efficiency improvements since 2000: industry has improved by 26%, transport sector by 23%, households by 10% and services sector by 3%. For households continuous improvements in energy efficiency were observed but slower than in the 90s due to changes in lifestyle and living comfort.

**Figure 7: Technical energy efficiency index (ODEX)**



Source: ODYSSEE

### 1.3. ENERGY EFFICIENCY POLICY BACKGROUND

To overcome the crisis caused by the COVID-19 pandemic, the European Union has devised a plan for the recovery and transformation of economies. This is the NextGenerationEU, a more than €800 billion temporary recovery instrument to help repair the immediate economic and social damage brought about by the coronavirus pandemic to create a post-COVID-19 Europe that is greener, more digital, more resilient and better fit for the current and forthcoming challenges. The Recovery and Resilience Facility: the centrepiece of NextGenerationEU with €723.8 billion in loans and grants available to support reforms and investments undertaken by EU countries. NextGenerationEU also includes €50.6 billion Recovery Assistance for Cohesion and the Territories of Europe (REACT-EU)

In order to access the funds of the NextGenerationEU, each Member State presented its own plan to define a coherent package of reforms and investments for the period 2021-2026.

In Italy the Recovery and Resilience Facility, the National Recovery and Resilience Plan (NRRP), guarantees resources for a total of €191.5 billion. Italy integrates the NRRP with a Complementary Fund, endowed with additional resources equal to €30.6 billion.

The Plan provides for an integrated set of investments and reforms aimed at improving the country's equity, efficiency and competitiveness, encouraging the attraction of investments and generally increasing the confidence of citizens and businesses. The Plan primarily consists of 6 Missions or Policy Areas which correspond to the 6 pillars of the EU Next Generation Plan:

- Mission 1: Digitalisation, innovation, competitiveness, culture and tourism
- Mission 2: Green revolution and ecological transition
- Mission 3: Infrastructure for sustainable mobility
- Mission 4: Education and research

- Mission 5: Inclusion and cohesion
- Mission 6: Health.

The Plan provides for interventions aimed at energy efficiency distributed within Missions:

- M1C3.1 Cultural Heritage for the Next Generation  
An intervention line will be financed.
  - Investment 1.3: Resources are made available to improve energy efficiency in cinemas, theatres and museums: buildings for cultural and recreational purposes are often found in obsolete and energy-inefficient buildings.
- M2C3 - Energy efficiency and building renovation  
M2C3 aims to improve the efficiency of public and private buildings, integrating renewable energy and stimulating local investments. M2C3 will finance 3 intervention lines:
  - M2C3.1: Implementation of a program to improve the efficiency and safety of public buildings, with interventions concerning in particular schools and judicial buildings. Two lines of investment will be financed and a reform will be carried out.
    - investment 1.1: Replacement of the part of the stock of school buildings that is obsolete, with the goal of creating modern and sustainable structures. In particular, the plan aims to a progressive replacement of the obsolete portion of the school building assets, intervening on around 195 school buildings for a total of 410 thousand sm, with a final reduction in energy consumption of at least 50% (3.4 ktoe per year). This will allow the reduction of annual greenhouse gas emissions by about 8,400 tCo2.
    - Investment 1.2: Efficiency of judicial buildings. The investment aims to intervene quickly with the inadequate structures that are negatively affect the delivery of judicial services, enhancing the historic patrimony but at the same time guaranteeing anti-seismic safety and energy and technology efficiency. Constant monitoring will allow minimizing the consumption and the environmental impact of the 48 redeveloped buildings: the goal is a reduction equal to around 2,500 tons of Co2 and 0.7 ktoe per year, with a resulting reduction in emissions of 2.4 ktCo2 per year.
    - Reform 1.1: Simplification and acceleration of procedures for carrying out interventions for energy efficiency.
  - M2C3.2: Introduction of a temporary incentive for energy requalification and anti-seismic renovations of private buildings and for social housing, through tax deductions for the costs incurred for the interventions. An investment line will be financed:
    - Investment 2.1: Ecobonus and Sismabonus up to 110% for energy efficiency and safety of buildings. The 110% Superbonus is a measure to finance the energy and seismic renovation of residential buildings, including social housing. The support is provided in the form of a tax deduction, deferred for 5 years (4 years for expenses incurred in 2022), for the subject that carries out the intervention. This tool stimulates local economies and lost jobs, and includes numerous measures, such as insulation solutions, efficient window frames, replacement of heating and air conditioning systems and installation of facilities for renewable energy production. The investments will allow the renovation of over 100,000 buildings when fully operational, with a total redeveloped area of more than 36 million square metres (of which 3.8 million are anti-seismic). The expected energy savings is around 191 Ktep/year with a reduction in greenhouse gas emission of about 667 ktonCo2/year.
  - M2C3.3: Promotion of efficient district heating system. An investment line will be financed:

- Investment 3.1: Support the development of 330 km of new efficient district heating networks and the construction of plants or connections for the recovery of 360 MW of waste heat, in order to save fossil primary energy and reduce greenhouse gas emissions. The investment finances 20 projects for the development of new networks (or the extension to new users of those that already exist). Priority is given to developing efficient district heating, i.e. district heating based on the distribution of heat generated from renewable sources, waste heat or co-generated in high-efficiency plants. Achieving this objective would allow, when fully operational, to achieve energy-environmental benefits equal to 20.0 ktoe of primary fossil energy saved per year and 0.04 MtCO<sub>2</sub> of greenhouse gas emissions avoided in non-ETS sectors every year.
- M2C4.2 Protection of the territory and water resources  
Actions aimed at increasing resilience, enhancing land and improving energy efficiency. An investment line will be financed:
  - Investment 2.2: The investment, with a budget of €6 billion, aims to support municipalities by financing a series of small (39,900) and medium-sized (7,200) public works, such as the upgrading of municipal buildings and the upgrading (including energy) of public lighting.
- M4C1 Strengthening the provision of education services: from nurseries to universities  
An investment line will be financed:
  - Investment 1.1: The investment plan for the 0–6-year-old age group aims to increase the availability of preschool facilities through the construction, refurbishment and improvement in the safety of crèches and nursery schools.
- M6C2.1 Technological and digital updating  
An investment line will be financed:
  - Investment 1.2: Towards new safe and sustainable hospitals. The goal of the investment is to improve structural safety - from an anti-seismic perspective - in 116 hospitals, identified during an inspection conducted by the Ministry of Health.

The NRRP also includes interventions in favour of sustainable mobility through Mission 3 “Infrastructures for sustainable mobility”. It consists of two components:

1. Investments in the railway network for the development of the Italian railway system: the main objective is to enhance the transport of passengers and goods by rail. The resources available amount to €24.8 billion;
2. Intermodality and integrated logistics includes interventions to support the modernization and digitalization of the logistics system. The resources available amount to €0.6 billion.

In January 2020, the Government sent the European Commission the National Integrated Energy and Climate Plan (PNIEC), as provided for in Regulation (EU) 2018/1999, thus completing the roadmap launched in December 2018 during which the Plan was the subject of a fruitful consultation between the institutions involved, citizens and all stakeholders.

The Plan sets the national targets to be achieved by 2030 for energy efficiency, renewable energy sources and the reduction of CO<sub>2</sub> emissions, as well as the objectives in terms of the energy security, interconnections, the single energy market and competitiveness, development and sustainable mobility, outlining for each of them the measures that will be taken to ensure that they are achieved. In particular, the Notification of Measures and Methods for the Application of Article 7, annexed to the Plan<sup>4</sup>, identifies and analyses the policy measures aimed at achieving the energy saving targets for the period 2021 - 2030. Compared to the binding energy saving target of 51.44 Mtoe, the proposed mechanisms lead to a cumulative estimated saving of 57.44 Mtoe.

The integrated national energy and climate progress reports drawn up under the said Regulation will also include information on the achievement of the national target in accordance with Article 7 EED. In particular, the report to be submitted by 30 April 2022 in accordance with Article 27 of the Regulation will also contain results relating to the achievement of the 2020 targets under Article 7 EED.

### 1.3.1. ENERGY EFFICIENCY TARGETS

Compared to the 2011-2020 target, envisaged in the National Energy Efficiency Action Plan (NEEAP) of 2017 and consistent with the National Energy Strategy of 2017, the energy savings achieved in 2020 amounted to just over 12,7 Mtoe/year, equivalent to just over 82% of the final target in 2020. Approximately 30% of these savings derive from tax deductions and over a quarter from the obligation scheme of the White Certificates (Table 1). It should be noted that the pandemic slowed down significantly the achievement of the expected target in 2020: blocking of production activities led to a minimum increase in annual savings deriving from the White Certificates mechanism (3.13 Mtoe/year in 2019) and the significant reduction in traffic volumes, especially road traffic, led to a reduction in the impact of Community Regulations and High Speed in the transport sector (2.63 Mtoe/year in 2019)

**Table 1: Achieved energy savings by sector, period 2011-2020 and expected for 2020 (final energy, Mtoe/year) according to the 2017 NEEAP**

Measure Sector	White Certificates	Tax deductions *	Conto Termico	Impresa 4.0	Structural funds	Information and training Plan	Marebonus e Ferrobonus	D.Lgs. 192/05 e D.Lgs. 26/6/15	Smart Working	Community Regulations and High Speed	Energy savings achieved in 2020	Energy savings expected by 2020	Achieved target (%)
Residential	0.76	3.49	0.2	-	-	0.04		1.84			6,33	3,67	172,5%
Services	0.16	0.03	0.07	-	0.03	0.01		0.09	0.43		0,82	1,23	66,6%
Industry	2.24	0.05	-	0.58	02	0.05		0.17			3,29	5,1	64,5%
Transport	0.01	-	-	-	-	-	0.16			2.12	2,29	5,5	41,6%
<b>Total</b>	<b>3.17</b>	<b>3.57</b>	<b>0.27</b>	<b>0.58</b>	<b>0.23</b>	<b>1</b>	<b>0.16</b>	<b>2.1</b>	<b>0.43</b>	<b>2.12</b>	<b>12,73</b>	<b>15,5</b>	<b>82,1%</b>

Source: ENEA elaboration of data from the Ministry of Economic Development, Ministry of infrastructures and transport, ISTAT, Gestore dei Servizi Energetici S.p.A., ENEA, FIAIP

With regard to the minimum energy saving target of 25.5 Mtoe of overall final energy to be achieved in the years 2014-2020 pursuant to article 7 of the Energy Efficiency Directive, the savings achieved in the years 2014-2019 and 2020 (estimated) through the notified measures are showed in table 2. The results are 91% of 2020 target.



**Table 2: Mandatory savings (Mtoe) pursuant to article 7 of the Energy Efficiency Directive, years 2014-2020**

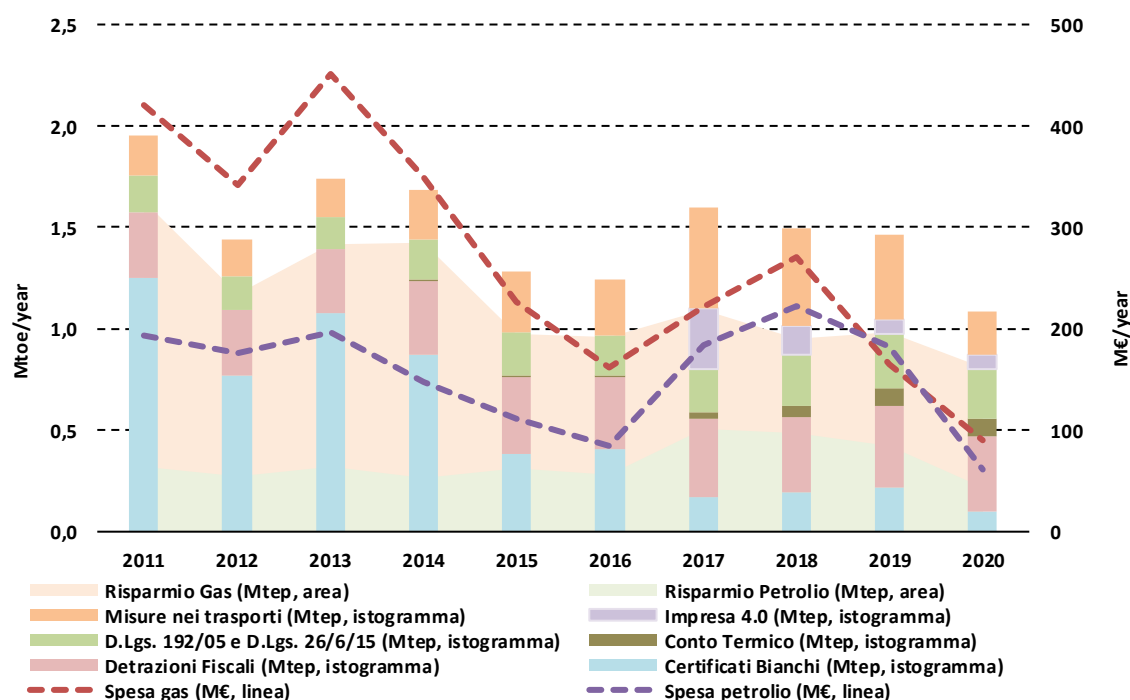
Notified measures	New Savings achieved							Cumulative savings	
	2014	2015	2016	2017	2018	2019	2020*	2014-2020	Expected in 2020
Mandatory scheme - White Certificates	0.872	0.859	1.102	1.346	1.186	1.517	1.510	8.392	10.65
Alternative measure 1 - Conto Termico	0.004	0.009	0.016	0.043	0.098	0.182	0.269	0.621	0.64
Alternative measure 2 - Tax deductions	0.364	0.739	1.091	1.480	1.850	2.251	2.617	10.391	10.41
Alternative measure 3 - National Energy Efficiency Fund	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.09
Alternative measure 4 - Impresa 4.0 National Plan	0.000	0.000	0.000	0.300	0.440	0.510	0.580	1.830	1.83
Alternative measure 5 - Cohesion policies	0.002	0.101	0.167	0.168	0.222	0.223	0.225	1.108	1.11
Alternative measure 6 - Information campaigns	0.000	0.015	0.026	0.084	0.088	0.094	0.104	0.411	0.40
Alternative measure 7 - sustainable mobility	0.000	0.000	0.000	0.000	0.087	0.240	0.156	0.483	0.42
<b>Total savings</b>	<b>1.242</b>	<b>1.722</b>	<b>2.403</b>	<b>3.421</b>	<b>3.971</b>	<b>5.017</b>	<b>5.461</b>	<b>23.236</b>	<b>25.56</b>

\* Preliminary estimate on data not yet consolidated

Source: Elaboration of the Ministry of Economic Development based on data from ENEA and Gestore dei Servizi Energetici S.p.A.

The figure 8 shows the cumulated savings on energy bill in the period 2011-2020 from new interventions carried out in each year considered as part of the main energy efficiency measures implemented. In particular, €151 million were saved in 2020 due to lower imports of natural gas (€90 million) and oil (€61 million). The the new interventions carried out in 2020 prevented the emission of over 2.6 Mton of CO<sub>2</sub>.

**Figure 8: Savings on National energy bills and energy savings, years 2011-2020**



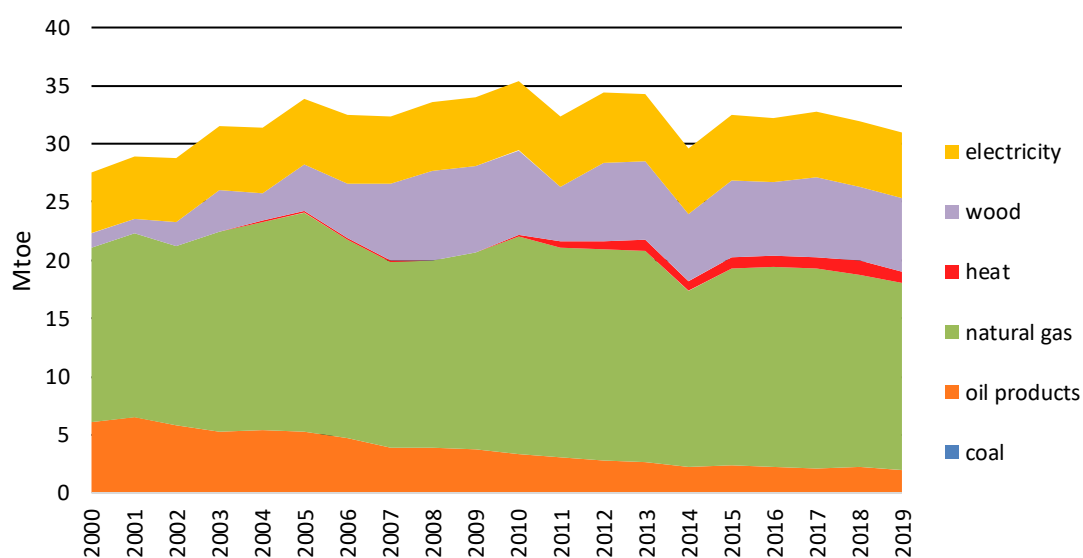
Source: ENEA elaboration

## 2. ENERGY EFFICIENCY IN BUILDINGS

### 2.1. ENERGY EFFICIENCY TRENDS

In 2019 the energy consumption of households amounted to 31 Mtoe, down by 2.9% compared to 2018: all energy sources decreased except electricity (Figure 9). Energy consumption increased until 2010 and then fell with negative peaks in 2011 (-8.5% due to the economic crisis) and 2014 (-13.7% due to a warmer winter). In the 2000-2019 period households consumption increased by 12.5%, +0.6% per year, characterized by a growth of 28.3% (+2.5% per year) in the period 2000-2010 and a decrease of 12.3% (-1.4% per year) from 2010. All energy sources have the same trend: in the period 2000-2019 natural gas consumption increased by 7.7% (+24.9% for the period 2000-2010 and -13.8% in the period 2010-2019), electricity consumption by 7.3% (+13.8% between 2000 and 2010 and -5.7% in 2010-2019), wood consumption increased at 8.8% per year (+18.9 per year in 1990-2010 and -1.4% per year in 2010-2019). The other fossil sources have a residual consumption: the drop in oil products was almost 70%.

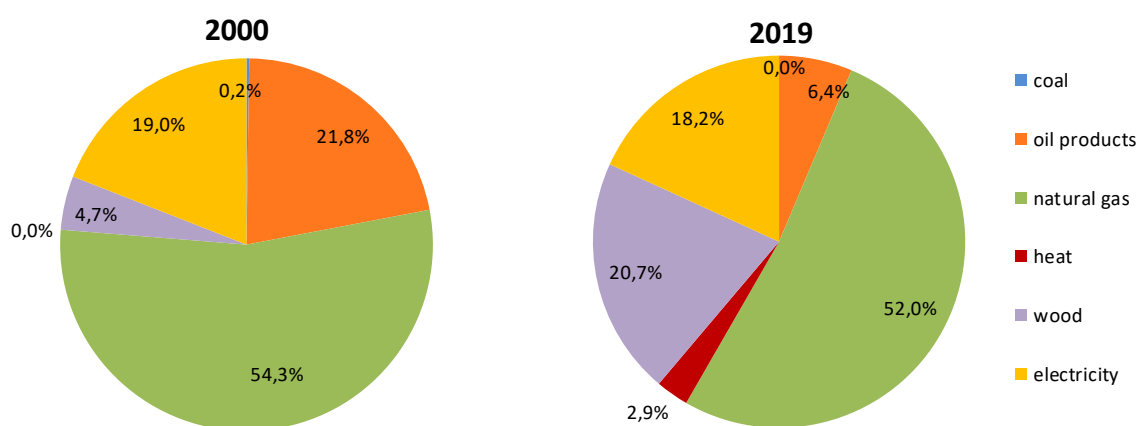
Figure 9: Energy consumption of households by energy source



Source: ODYSSEE

Natural gas is the main energy source with a share of over 50% of total energy consumption of the sector, followed by wood with 20.7% and electricity with 18.2%. The share of oil products decreased by 15 percentage points since 2000 (Figure 10).

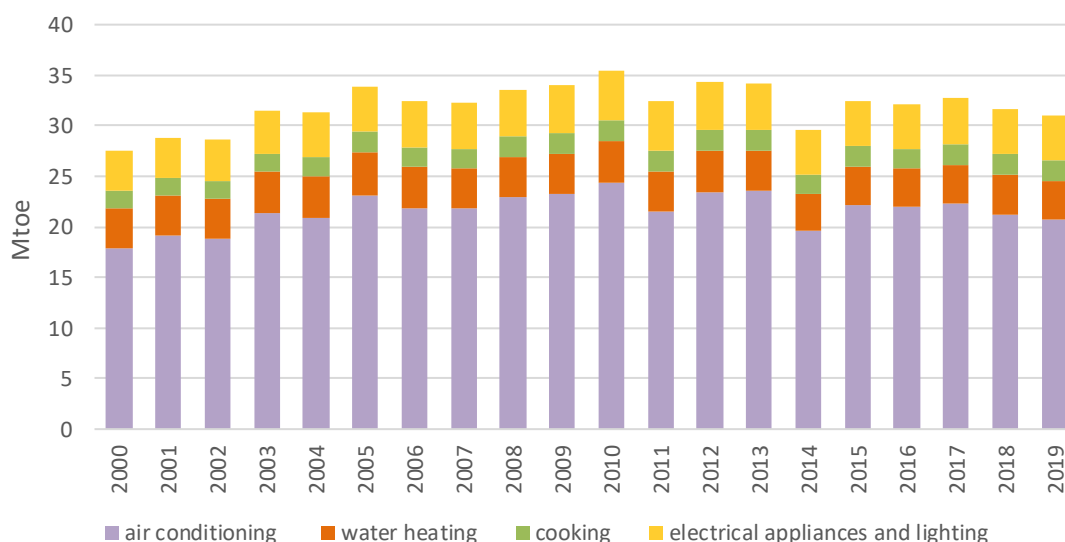
**Figure 10: Shares of energy consumption by energy source in households**



Source: ODYSSEE

In 2019 the share of energy consumption absorbed by air conditioning (space heating and cooling) was almost 70%, down by 1.9% compared to 2018, influenced by temperatures. The other types of end-use decreased compared to (figures 11). In the period 2000-2019, the energy consumption for air conditioning increased by 16.3%, for lighting and electrical appliances by 11%, for cooking by 23.2%. Only exception is energy consumption for water heating down by 6%.

**Figure 11: Energy consumption by types of end-use in households**

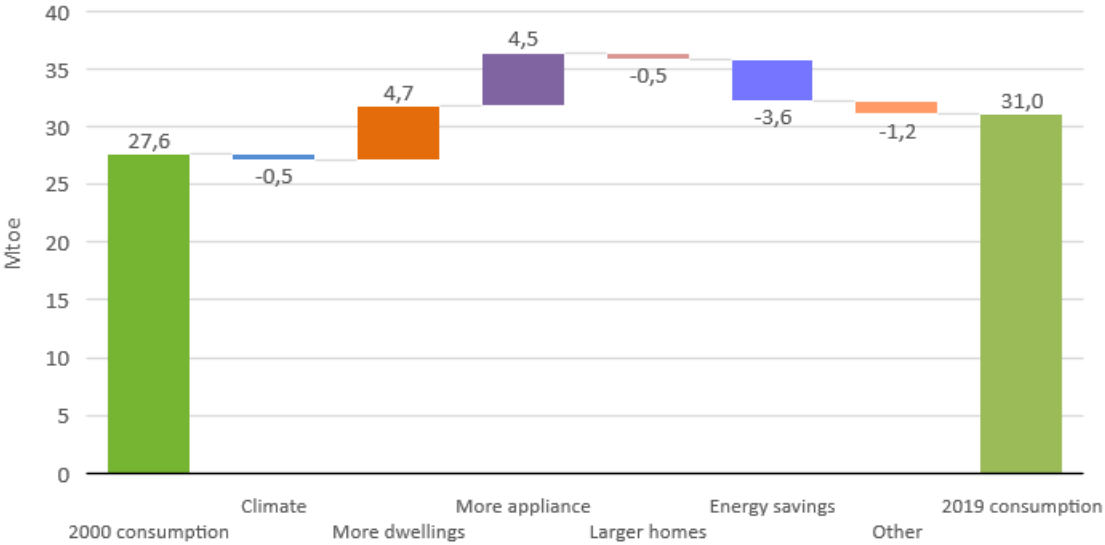


Source: ODYSSEE

Over the period 2000-2019 the energy consumption of households grew by 3.5 Mtoe. This increase was mainly due to two factors: more dwellings for 4.7 Mtoe, and better lifestyle for 4.5 Mtoe, especially more appliances per dwelling for a better comfort). Energy savings have counterbalanced

the effects of the energy consumption growth for 3.6 Mtoe (figure 12). These trends are also showed by the ODEX index.

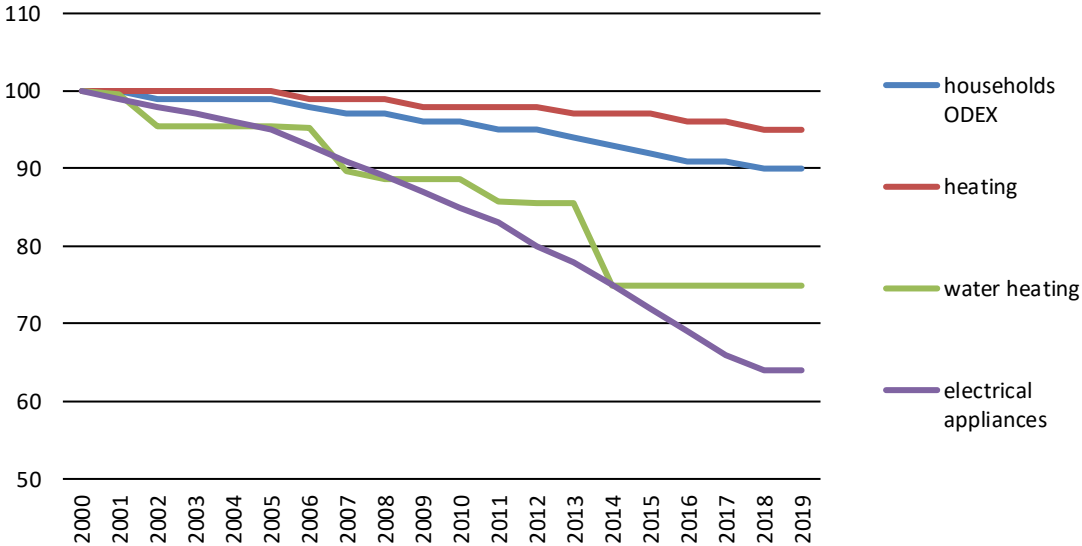
**Figure 12: Variation households consumption – Italy – Mtoe (2000-2016)**



Source: ODYSSEE

Energy efficiency in households improved by 10% in the period 2000-2019 (Figure 13). The slowdown compared to the 1990s is due to an increase in energy consumption for heating.

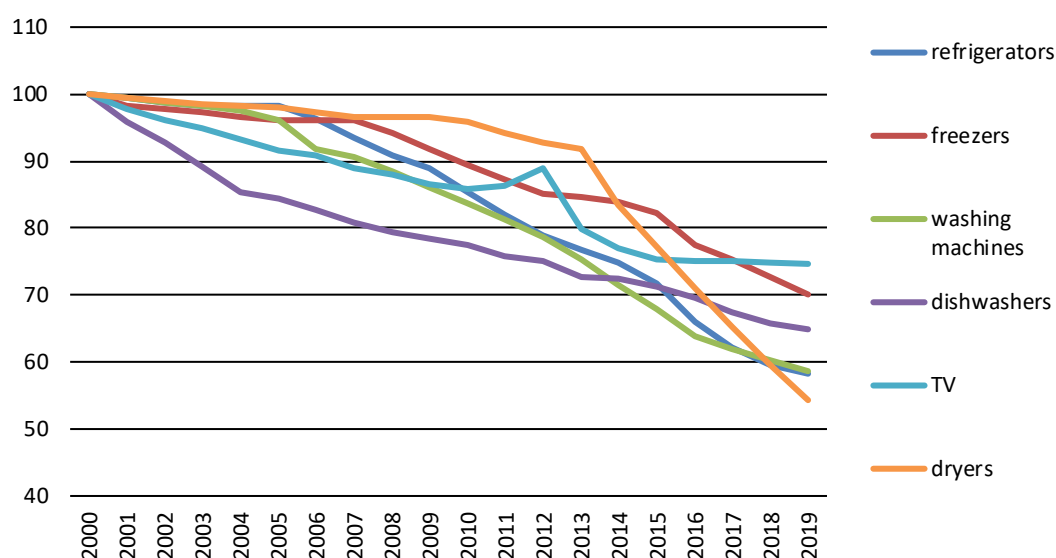
**Figure 13: Energy efficiency in households by index ODEX (2000=100)**



Source: ODYSSEE

Energy efficiency of electrical appliances improved by 36%, at average 2.3% per year, due to considerable reductions in energy unit consumption (figure 14). Energy efficiency of water heating and heating improved, respectively, by 25% and 5%.

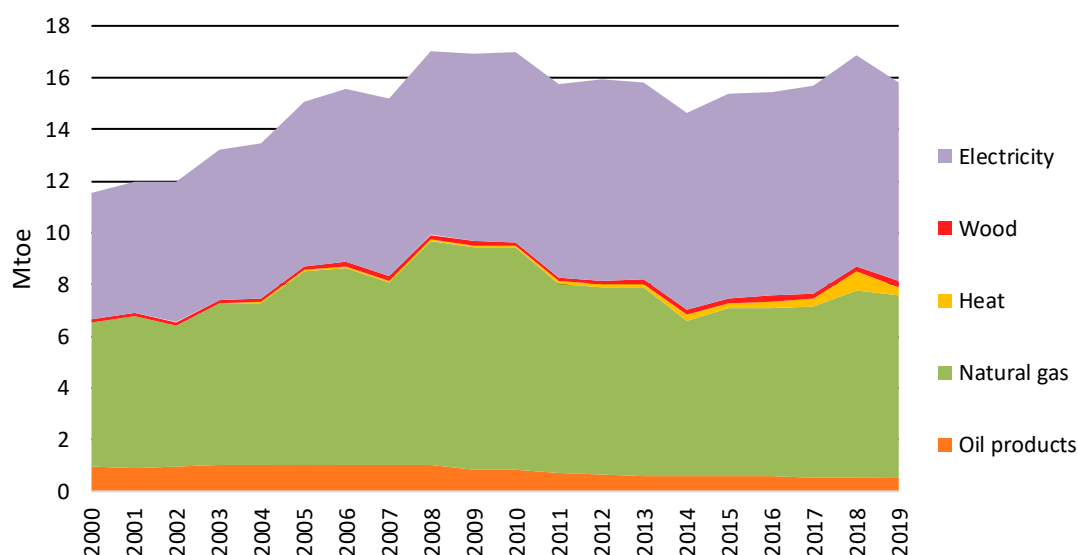
**Figure 14: Energy unit consumption of electrical appliances in households (2000=100)**



Source: ODYSSEE

In 2019 the services sector consumed 15.8 Mtoe, down by 6.2% compared to 2018. Services were the driving sector in the period 2000-2019 with a growth of 36.8% at an average 1.7% per year. The main energy sources in the sector are electricity and natural gas with over 90% of total consumption. In 2019 electricity share was 48.6%, natural gas share 44.9%: in 2000 the weights were reversed (figure 15)

**Figure 15: Energy consumption of services sector by energy source**

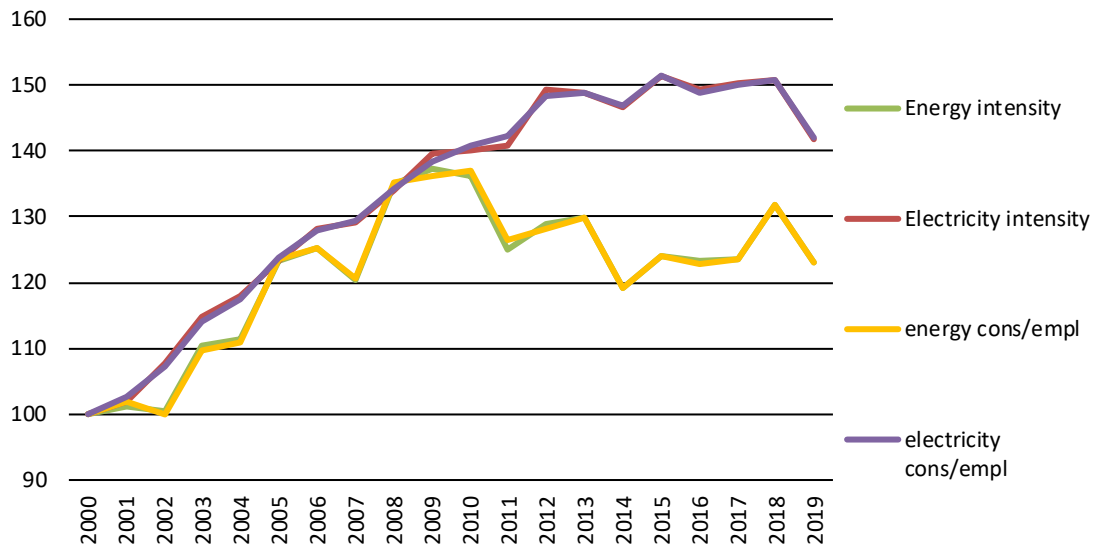


Source: ODYSSEE

Energy intensity shows the growth of the sector: over the period 2000-2019 energy intensity increased by 23%, electricity intensity by 41.7%. Consumption per employee also confirmed this trend in the 2000-2019 period: + 23.1% for energy consumption per employee, + 41.9% for electricity consumption

per employee (figures 16). In recent years, the growth of the indicators has get slower due to a slowdown in energy consumption compared to value added and to employees.

**Figure 16: Energy intensity and energy consumption per employee in services sector (2000=100)**



Source: ODYSSEE

## 2.2. ENERGY EFFICIENCY POLICIES

Budget Law 2020 extended tax deductions for energy requalification of existing buildings (Ecobonus) and fiscal deductions for building renovations (Bonus Casa) until 31 December 2020 with regard to expenditure incurred from 1 January to 31 December 2020.

Law Decree 34/2020 raised the tax deduction rate for some energy efficiency and anti-seismic interventions to 110% of the expenditure incurred (Superbonus) to give an important boost to the economy following the Sars-CoV-2 pandemic.

Legislative Decree 48/2020 provides for a long-term strategy to support the renovation of the national park of residential and non-residential buildings, both public and private, in order to obtain a decarbonised and energy-efficient real estate park by 2050. The strategy will be incorporated in the PNIEC. The PNIEC establish to stabilize the tax deductions for the energy requalification and renovation of buildings for a period of at least three years, to take all the incentives in a single mechanism, to modulate the benefit in relation to the expected energy savings.

The programme for the improvement of the energy performance of the central PA buildings (PREPAC) has been refinanced for the period 2021-2030 (Legislative Decree 73/2020).

Table 3 shows the energy savings from tax deduction for years 2014-2020, this amount is considered for the purpose of achieving the objectives set out in Article 7 of the Energy Efficiency Directive: the overall energy savings achieved in 2020 through new interventions incentivized by the three forms of tax deduction described are approximately 0.37 Mtoe/year.

**Table 3: Energy savings from tax deductions (Mtoe/year), years 2014-2020**

measure	2014	2015	2016	2017	2018	2019	2020	TOTAL
Ecobonus	0.093	0.094	0.096	0.112	0.099	0.108	0.117	<b>0.718</b>
Bonus Casa	0.271	0.281	0.257	0.277	0.270	0.293	0.247	<b>1.896</b>
Superbonus							0.003	<b>0.003</b>
<b>TOTAL</b>	<b>0.364</b>	<b>0.375</b>	<b>0.353</b>	<b>0.389</b>	<b>0.370</b>	<b>0.401</b>	<b>0.366</b>	<b>2.617</b>

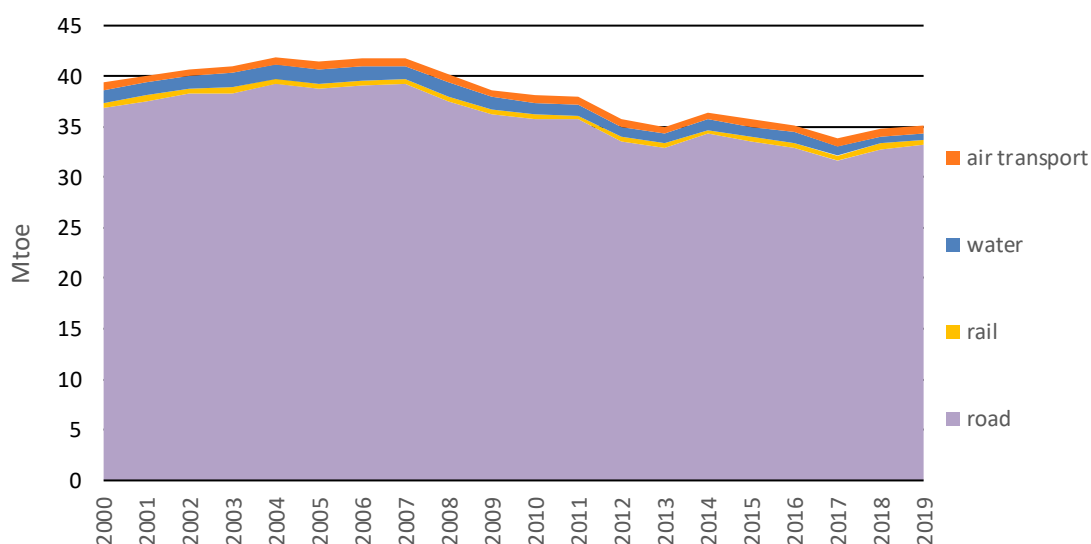
Source: ENEA

### 3. ENERGY EFFICIENCY IN TRANSPORT

#### 3.1. ENERGY EFFICIENCY TRENDS

In 2019, the energy consumption of transport sector (excluding consumption for international air transport and pipelines) amounted to 35.7 Mtoe, + 0.9% compared to previous year, confirming the growth started in 2018 after a decade of constant drops. The main mode of transport is road transport, both for passenger and freight transport, with over 90% of the total consumption of sector despite the reductions in the years 2008-2017. The other modes of transport have a limited weight: in 2019, national air consumption absorbed 2.5% of total consumption, water transport 1.7% and rail transport 1.5% (figures 17).

**Figure 17: Energy consumption of transport sector by mode**

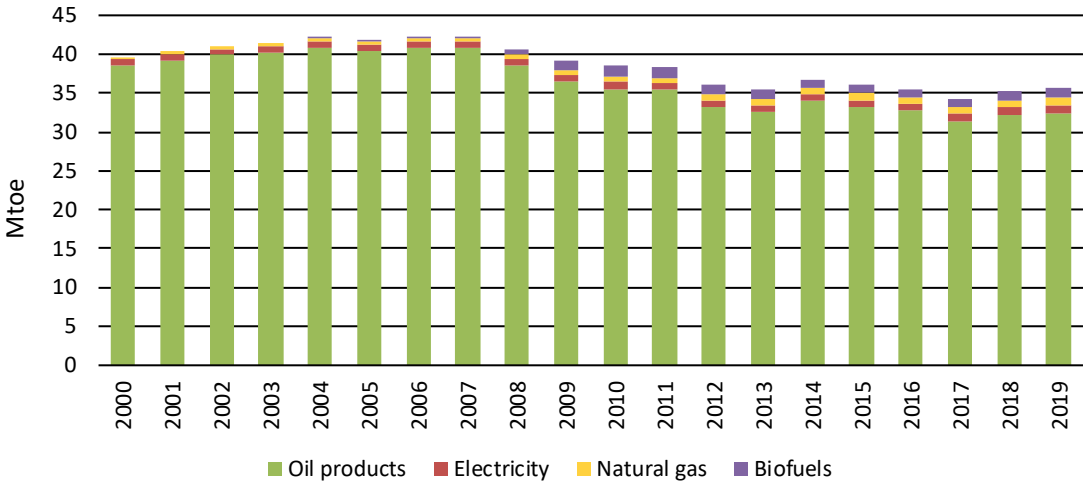


Source: ODYSSEE

The weight of road transport is reflected in the mix of used energy: oil products absorb over 90% of total consumption but their share dropped from 97.4% in 2000 to 91% in 2019. Biofuels cover 3.6% of total consumption of sector in 2019: Biofuels grew rapidly until 2010, decreased in the years 2010-2016 and then back to growth: in 2019 consumption eas 1.3 Mtoe. The consumption of electricity and

natural gas is constantly increasing: over period 2000-2019, the consumption of electricity grew by 42.7%, the consumption of natural gas by almost 200%, reaching 2.7% of total consumption (figure 18).

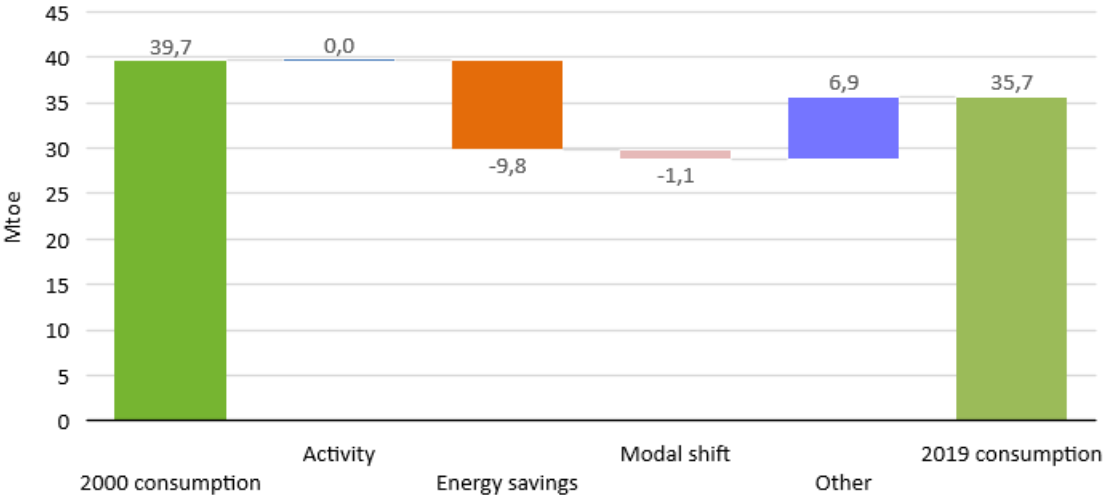
**Figure 18: Energy consumption of transport sector by fuel**



Source: ODYSSEE

Energy consumption in the transport sector increased until 2007 and then decreased due to the economic crisis: since 2017 consumption started to grow again. Over period 2000-2019, energy consumption decreased by 4 Mtoe, -10.1%. The reduction in energy consumption was due to energy savings related to improvement in energy efficiency of energy specific consumption for 9.8 Mtoe and to modal shift for 1.1 Mtoe. This good result was constrained by the other effects, mainly the reduction of the transport load factor for the freight traffic, which produced an increase in consumption of 6.9 Mtoe.

**Figure 19: Variation transport consumption – Italy – Mtoe (2000-2013)**

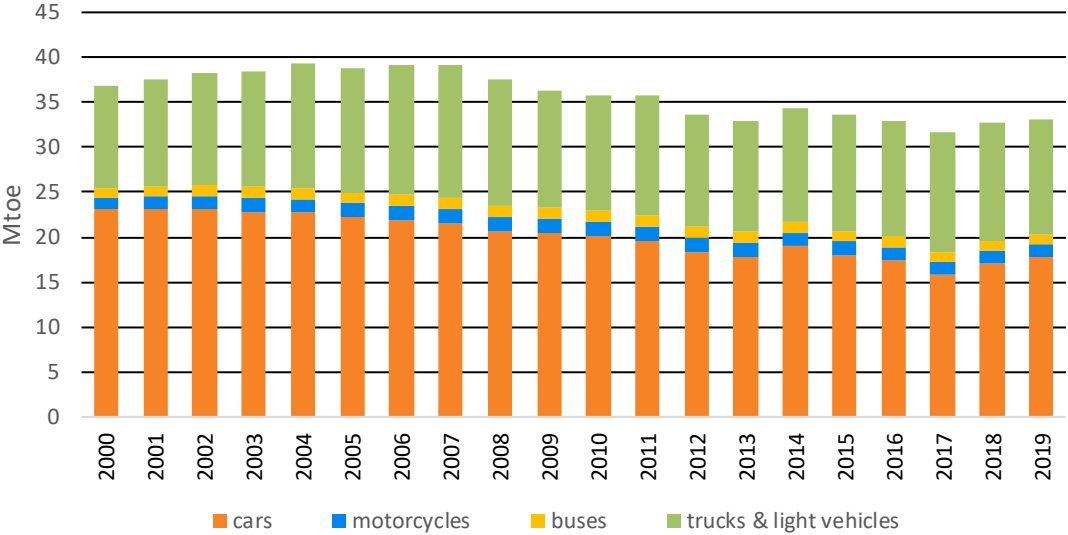


Source: ODYSSEE



In 2019 the energy consumption of road transport was 33.1 Mtoe, +1% compared to the previous year, confirming the positive trend started in 2018: over the period 2000-2019 road transport reduced energy consumption by 10.1%. In 2019 cars consumption amounted to 17.8 Mtoe, over 50% of energy consumption of road transport (over 60% in 2000), followed by commercial vehicles (figure 20).

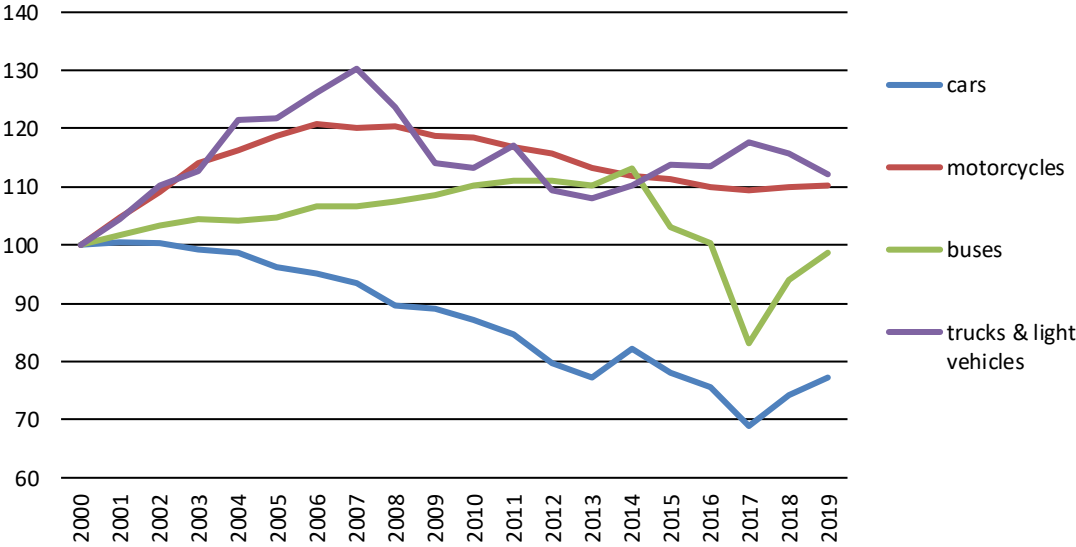
**Figure 20: Energy consumption of road transport by mode**



Source: ODYSSEE

In the period 2000-2019, the energy consumption of cars reduced by 22.8% due to more efficient new cars, shift from gasoline- cars to other types of cars and the economic crisis of 2007. The other modes of road transport had an increase in energy consumption but with drops in the last years.

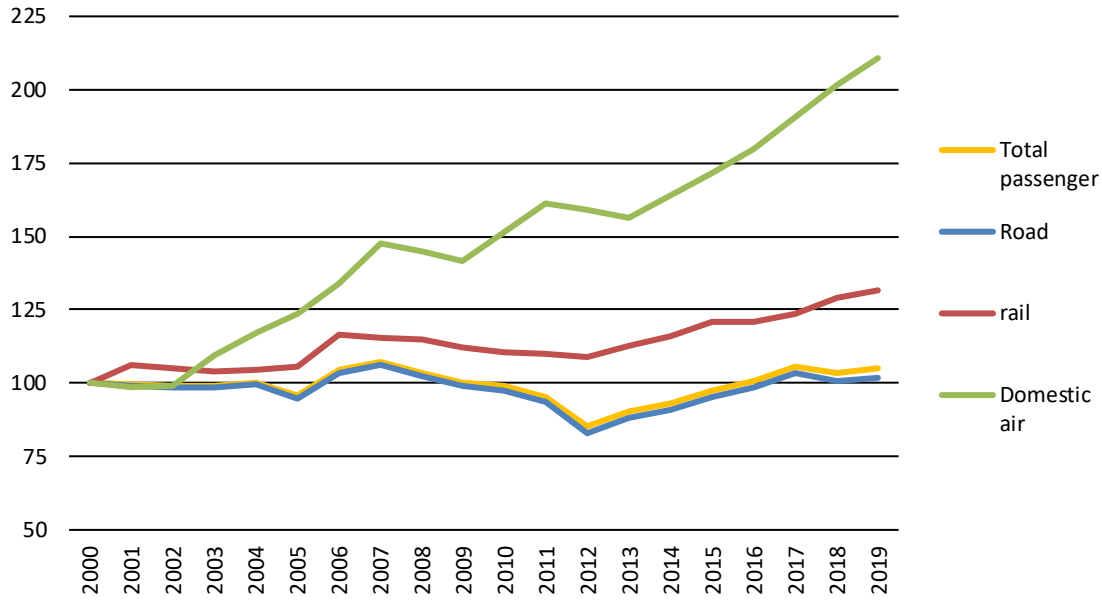
**Figure 21: Energy consumption trends of road transport (2000=100)**



Source: ODYSSEE

The passenger traffic has been growing continuously since 2012 at 3% per year over the period 2012-2019 after the drop in the years 2007-2012: + 5% in the period 2000-2019 (figure 22). The share of cars is slightly decreasing, -3 percentage points, in 2000-2019, while the share of public transport is growing.

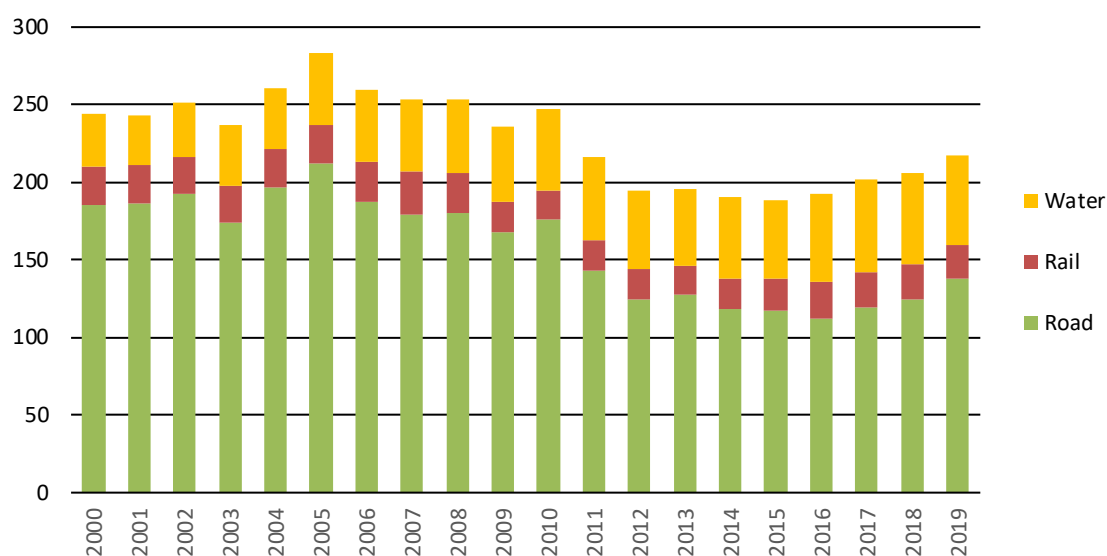
**Figure 22: Passenger transport by mode (2000=100)**



Source: ODYSSEE

The freight traffic has been increasing in the last years but it reduced by 10,8% (-0.6% per year) since 2000. This drop over the period 2000-2018 is driven by the significant decrease in road goods traffic (-1.5% per year), especially since 2011, and in rail traffic (-0.8% per year). On the contrary, water goods traffic is increasing, +2.9% per year (figure 23). In 2019 road goods traffic were 63.5% of all freight traffic against 75.9% in 2000.

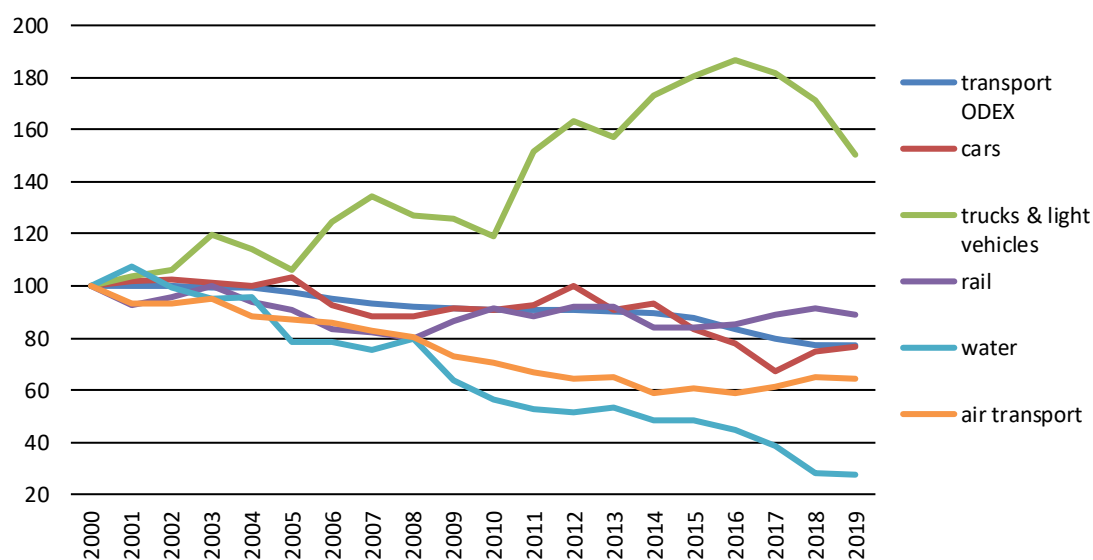
**Figure 23: Goods traffic transport by mode and energy consumption**



Source: ODYSSEE

Energy efficiency of the transport sector in 2019 was 77.2, achieving an improvement of 22.8% in the period 2000-2019 (Figure 24). The efficiency of the transport sector depends mainly on the energy efficiency of road transport because cars and trucks and light vehicles cover more than 90% of total energy consumption. In the period 2000-2019 the energy efficiency of cars improved by 23.5% while the energy efficiency of trucks and light vehicles worsened by 50.6% but it has been improving in last years. The other modes of transport improved in energy efficiency but their impact is limited: 35.8% in air transport and 11.4% in rail transport over the period 2000-2019.

**Figure 24: Energy efficiency in transport sector (2000=100)**



Source: ODYSSEE

### 3.2. ENERGY EFFICIENCY POLICIES

The "National Strategic Plan for Sustainable Mobility" provides €3.7 billion for 2019-2033 for the renewal of the bus fleet with electric, methane and hydrogen vehicles.

Budget Law 2020 provided for incentives for the scrapping of old vehicles and the purchase of new vehicles for passenger transport "Euro VI" and powered by natural gas, hybrid and electric. The Law establishes the obligation from January 2020 for PA to purchase or rent vehicles powered by electricity, hybrid or hydrogen no less than 50% of the total when renewing the vehicles.

2021 Budget Law refinanced until 2026 the incentives for the transfer of goods from road to sea (marebonus with €20 million in 2021) and rail (ferrobonus with €14 million in 2020 and €25 million in 2021).

Table 4 shows the energy savings in final and primary energy of transport sector achieved in 2019 and estimated in 2020.

**Table 4: Energy savings in transport sector, 2019 and 2020 (estimated)**

Mtoe/year	2017		2017	
	Final energy	Primary energy	Final energy	Primary energy
Eco-car incentives 2007-2009	0.156	0.171	0.118	0.130
EC Regulation 443/2009	2.167	2.395	1.904	2.103
EC Regulation 510/2011	0.090	0.101	0.100	0.114
Renewal Autobus TPL	0.001	0.001	0	0
Marebonus	0.191	0.200	0.137	0.144
Ferrobonus	0.049	0.053	0.019	0.021
High Speed	0.115	0.105	0	0
<b>Total</b>	<b>2.769</b>	<b>3.026</b>	<b>2.278</b>	<b>2.491</b>

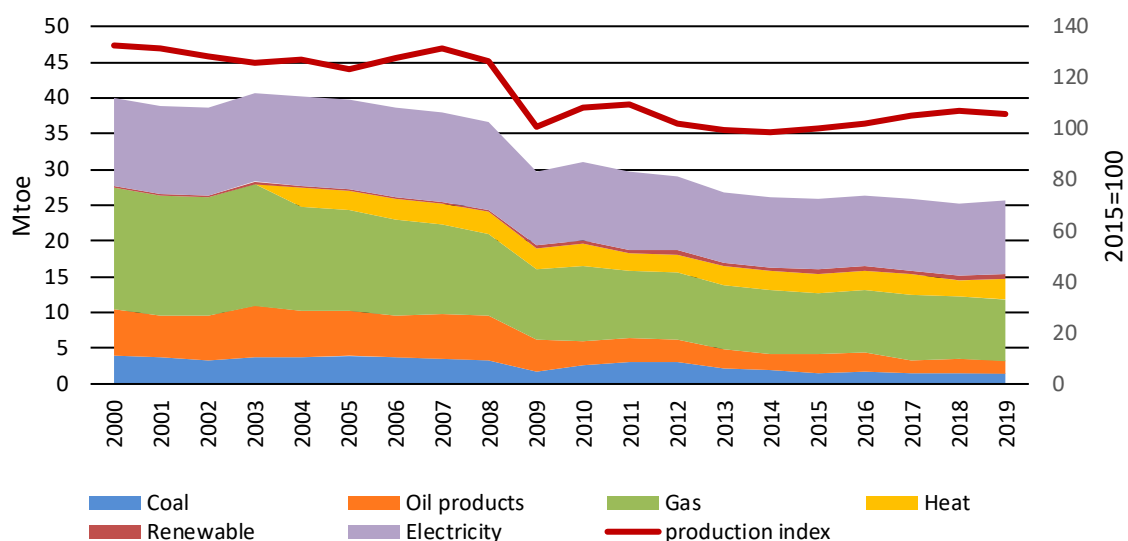
Source: ENEA elaboration

## 4. ENERGY EFFICIENCY IN INDUSTRY

### 4.1. ENERGY EFFICIENCY TRENDS

Final energy consumption in industry, including blast furnaces, amounted to 25.8 Mtoe in 2019, with an increase of 2.5% compared to 2018, in countertrend to the previous years. Consumption of the sector showed constant decreases since 2000 except for a few years of growth: over the period 2000-2019, energy consumption reduced by over 14 Mtoe, -35.6% at -2, 3% per year (Figure 25). The industrial production index showed the same trend in energy consumption up to 2014 and then was in countertrend to energy consumption. The drop in energy consumption involved all energy sources: in the period 2000-2019 oil products dropped by 73.8% (-6.8% per year), solid fuels by 63.1% (-5.1% per year), gas by 48.9% (-3.5% per year) and electricity by 15.7% (-0.9% per year). The consumption of renewable sources is growing at 4.1% per year reaching consumption of 0.7 Mtoe. Heat consumption is also on the growth.

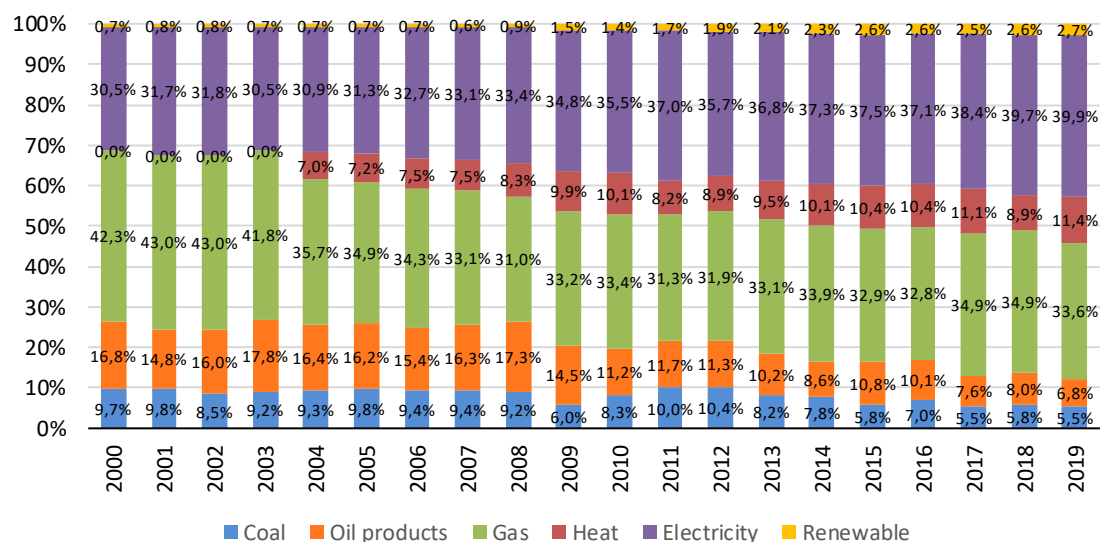
**Figure 25: Energy consumption in industry by fuel and industrial production index (2010=100)**



Source: ODYSSEE

Electricity and gas are the main sources of energy with over 70% of total consumption. In 2019 electricity absorbed 39.9% of total consumption, more than almost 10 percentage points since 2000, followed by gas with 33.6%, down by almost 9 percentage points (Figure 26). The share of other fossil fuels fell by more than 14 percentage points.

**Figure 26: Shares of energy consumption by fuel in industry**

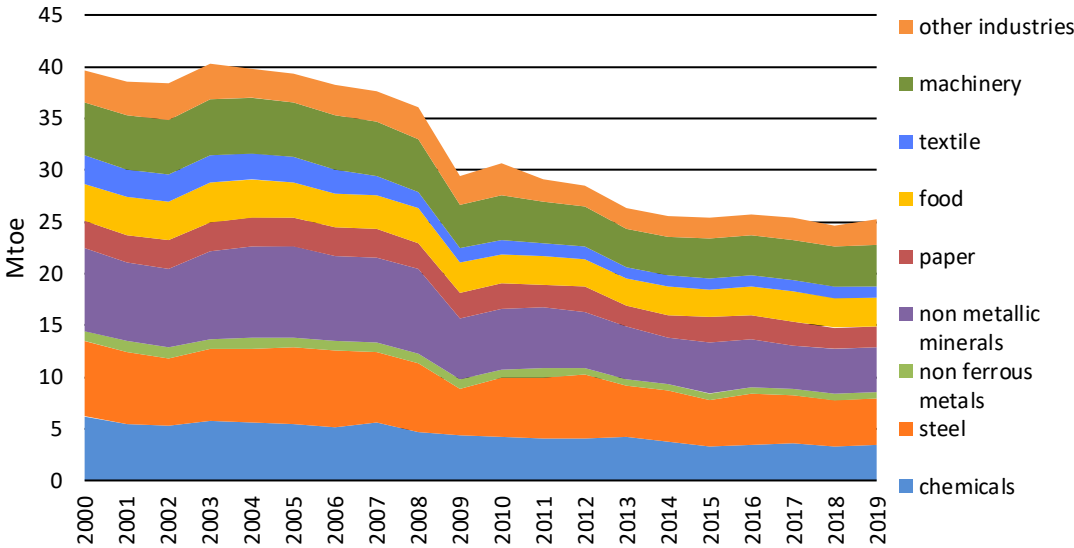


Source: ODYSSEE

The performance in industry depends on manufacturing industry: in 2019 the energy consumption of the manufacturing industry amounted 25.4 Mtoe, + 2.4% compared to 2018 and -36.2% since 2000.

All industrial branches showed a similar trend in energy consumption: after the increases in the 1990s, decreases accentuated in the years of the economic crisis with a negative peak in 2009, when all sectors had significant reductions in energy consumption, even if in different ways (figure 27). In the last decade (2010-2019), a decreasing trend in energy consumption has been observed for all sectors, with the exception of the construction sector and the food industry. In the period 2000-2019 the drops in energy consumption were more than 40% for chemicals (-43.3%), non-metallic minerals (47.6%) and textiles (-58.7%), higher than 30% for the steel industry (-39.2%) and non-ferrous metals (-31.3%). In 2019, the industrial branches showed different trends in energy consumption compared to 2018: decreases were observed in non-metallic mineral, non-ferrous metals and textiles, increases in chemicals, construction and mining sectors, and a stable trend in the other sectors.

**Figure 27: Energy consumption of manufacturing industry by branch**

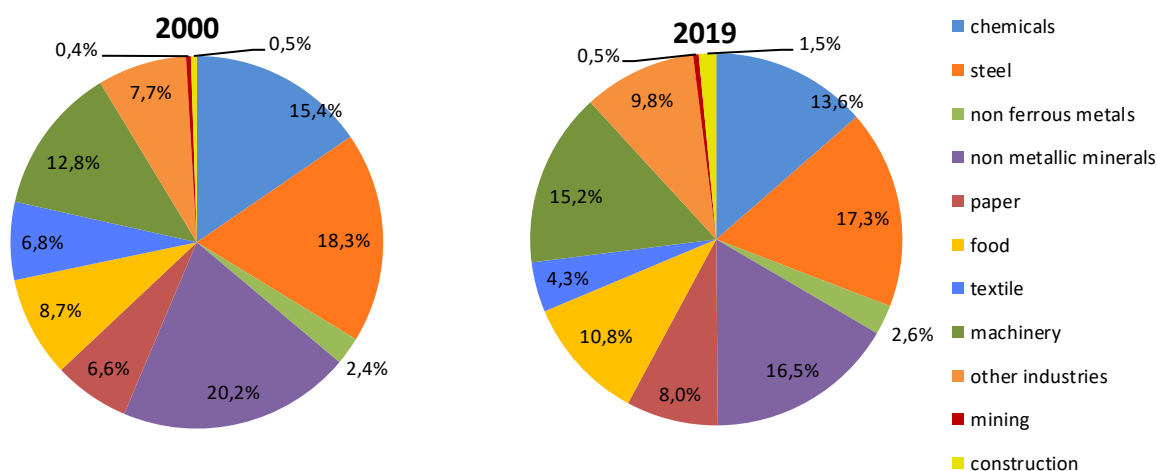


Source: ODYSSEE

Industrial production decreased in the period but less than the energy consumption as evidence of improvement in energy efficiency.

Energy-intensive branches absorb about 60% of the final energy consumption of industry but their weight is decreasing from 63% in 2000 to 57.9% in 2019 (figure 28). In particular, in 2019 primary metal absorbed 20% of total consumption, followed by non-metallic minerals (16.5%), chemicals (13.6%) and paper (8%). The other branches consumed less than 10% of total consumption except for machinery (15.2%) and the food (10.8%).

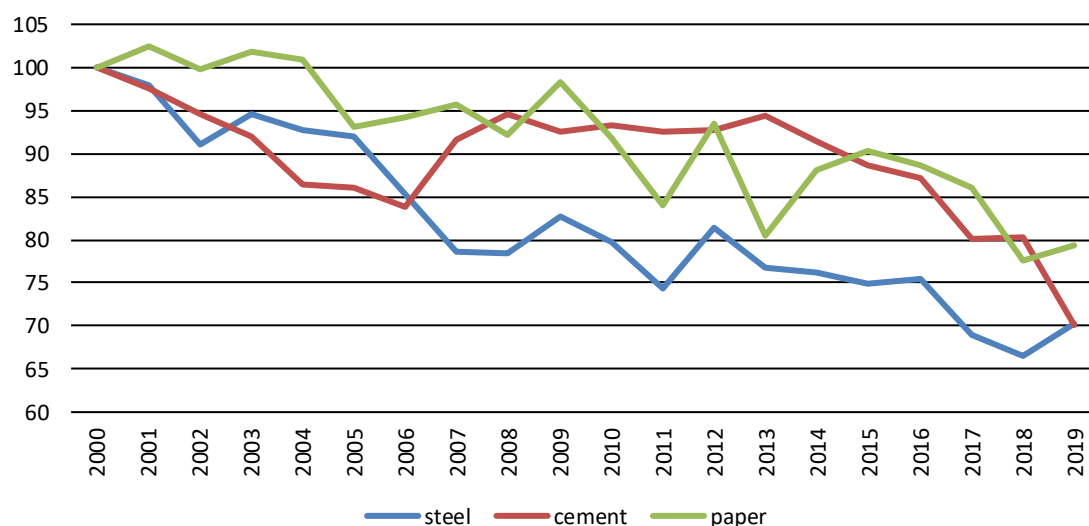
**Figure 28: Shares of energy consumption by branch in industry**



Source: ODYSSEE

The unit consumption of steel, including blast furnaces consumption, reduced by 1.8% per year in the period 2000-2019, with some negative years due to unused production capacity caused by the economic crisis. The unit consumption of cement fell by 1.9% per year: it remained quite stable over the period 2008-2013 and then decreased. The unit consumption of paper dropped at 1.2% per year (Figure 29).

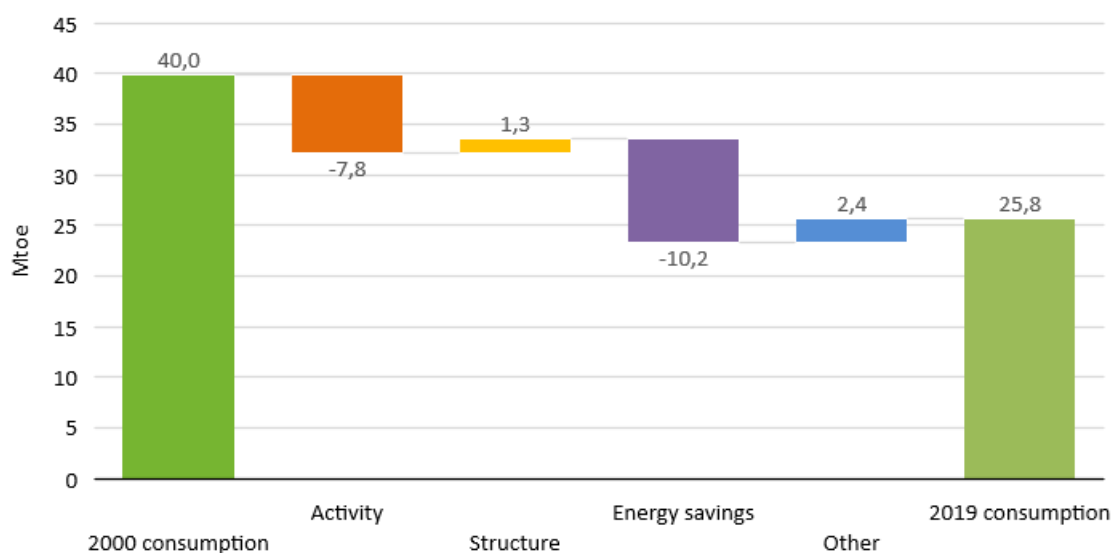
**Figure 29: Unit consumption of energy-intensive products (toe/t, 2000=100)**



Source: ODYSSEE

The decrease in industry energy consumption was 14.2 Mtoe (-35.6%) over the period 2000-2019. The reduction was mainly driven by energy savings related to the improvement in energy efficiency (-10.2 Mtoe) and the slowdown in activity due to the economic crisis and recession (-7.8 Mtoe) (figure 30).

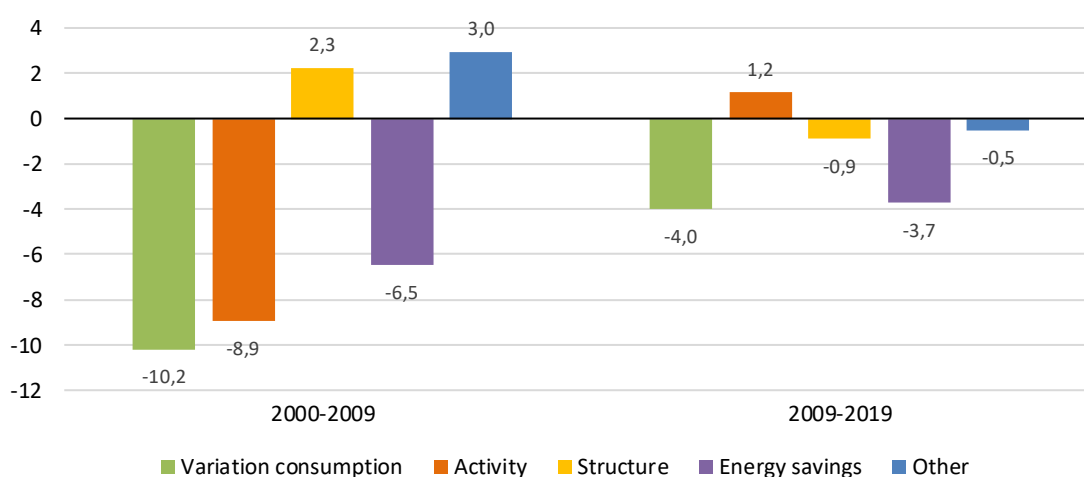
**Figure 30: Variation industry consumption – Italy – Mtoe (2000-2016)**



Source: ODYSSEE

The variation of energy consumption in industry before and after the crisis is shown in figure 31. The figure illustrates as the improvement in energy efficiency, represented by energy savings, occurs in both periods: 6.5 Mtoe of energy savings in the period 2000-2009 and 3.7 Mtoe in the period 2009-2019. Industrial activity, measured by the industrial production index, caused a reduction in energy consumption of 8.9 Mtoe in the period 2000-2009 (-23.8% of the industrial production index) and an increase of 1.2 Mtoe in the period 2009-2019 (+4.8 in industrial production).

**Figure 31: Variation industry consumption – Italy: before and after the crisis**



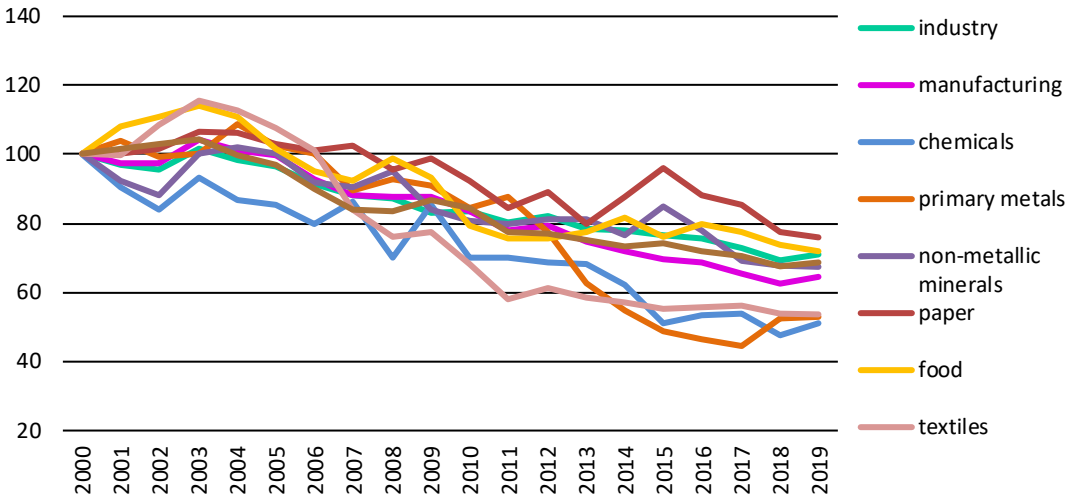
Source: ODYSSEE

In 2019, the energy intensity of the industry was 74.6 toe/M€<sub>2015</sub> with an increase of 2.2% compared to 2018. The indicator had a value higher than 100 toe/M€<sub>2015</sub> up to 2005 to then rapidly decrease with the decreases in final energy consumption of all sectors and, in particular, in the primary metals, textile



and non-metallic minerals branches (figure 32). In the period 2000-2019, energy intensity decreased by 29.2%.

**Figure 32: Energy intensity in industry sector (2000=100)**

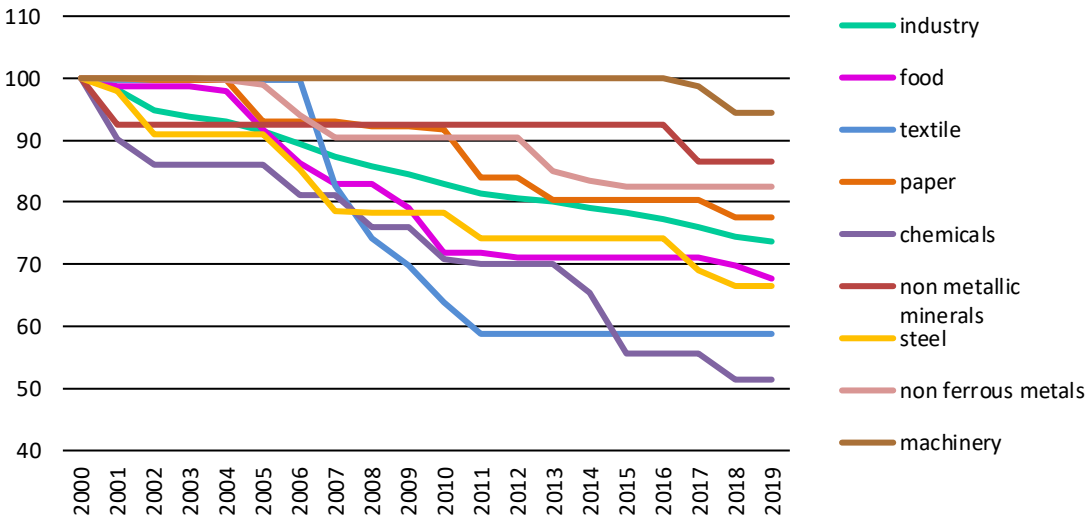


Source: ODYSSEE

The energy intensity of all sectors decreased in the period 2000-2019: the greatest reductions were observed in chemicals (-49.1%), primary metal (-46.9%) and textiles (-46.3 %) due to drop of activity and an improvement in energy efficiency especially since 2007.

The energy efficiency of industry, measured by the technical ODEX index, improved by 26.3% in the period 2000-2019 at 1.6% per year (Figure 33).

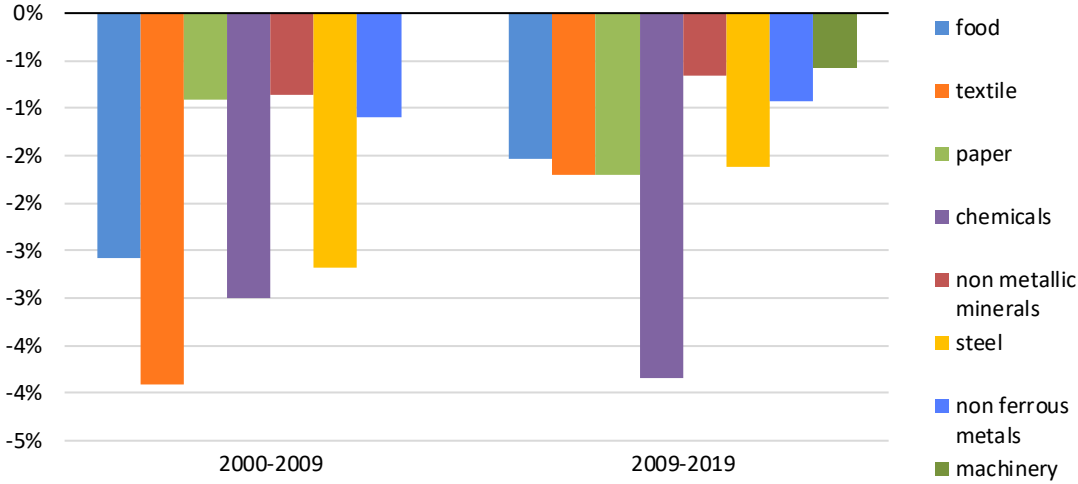
**Figure 33: Energy efficiency index in industry (2000=100)**



Source: ODYSSEE

All industrial sectors have improved in energy efficiency over the period 2000-2019. In the years following the crisis, improvements in energy efficiency have been slower due to unused production capacity, except for paper, chemicals and machinery: machinery achieved improvements in energy efficiency only in recent years (figure 34).

**Figure 34: Energy efficiency trends in industrial branches (%/year)**



Source: ODYSSEE

**4.2. ENERGY EFFICIENCY POLICIES**

Budget Law 2020 launched Transition Plan 4.0. The Plan has a three-year program (2020-2022) and provides greater attention to innovation, green investments and design activities and aims to incentivize and support companies through tax credits for investments in the process of technological transition and environmental sustainability (capital assets, research and innovation, training 4.0). The entire plan involves an injection of resources for all types of companies (large and micro, medium and small) equal to approximately €7 billion. In addition, these companies will have access to additional resources of around €1 billion, specifically dedicated to large research, development and innovation projects.

The Law also refinanced “Nuova Sabatini” for years 2020-2025.

Budget Law 2021 increased tax credit for investments in capital assets, 10% until 31 December 2022, in research and development, technological innovation, 20% up to 4 million euro, for ecological transition and digital innovation 4.0, 15% up to €2 million.

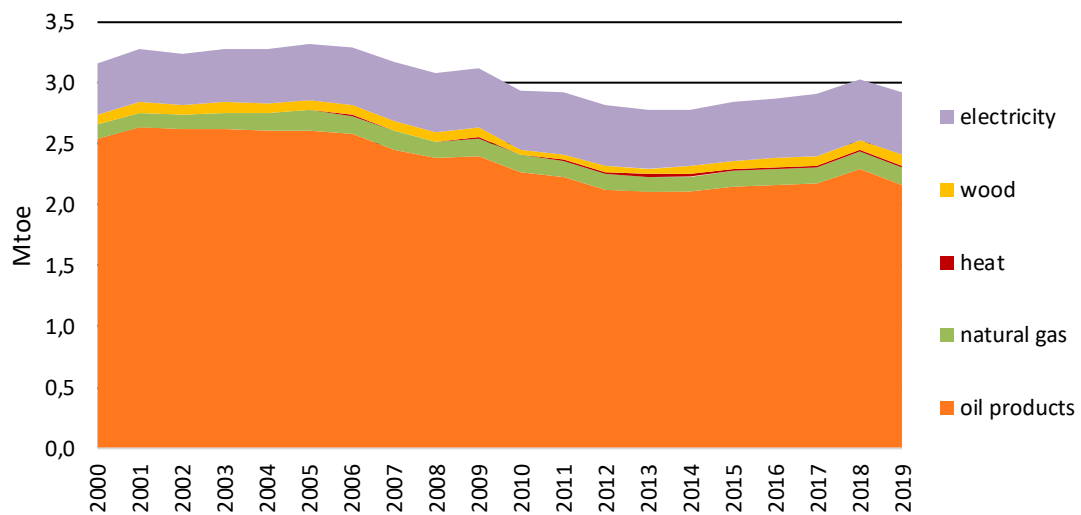
The Legislative Decree 102/2014 (art. 8, comma 10) reserves up to €15 million per year over the period 2014-2020 for the co-financing of regional programmes aimed at supporting the implementation of energy diagnosis or the adoption of management systems compliant with ISO 50001 in SMEs.

## 5. ENERGY EFFICIENCY IN AGRICULTURE

### 5.1. ENERGY EFFICIENCY TRENDS

In 2019, energy consumption in agriculture amounted to 2.9 Mtoe, down by 3.4% compared to 2018: the decrease in the period 2000-2019 was 7.4%. The main energy source are oil products that in 2019 absorbed 74% of total energy consumption (80% in 2000), followed by electricity with 17.8% (Figure 35).

**Figure 35: Energy consumption in agriculture by energy source**

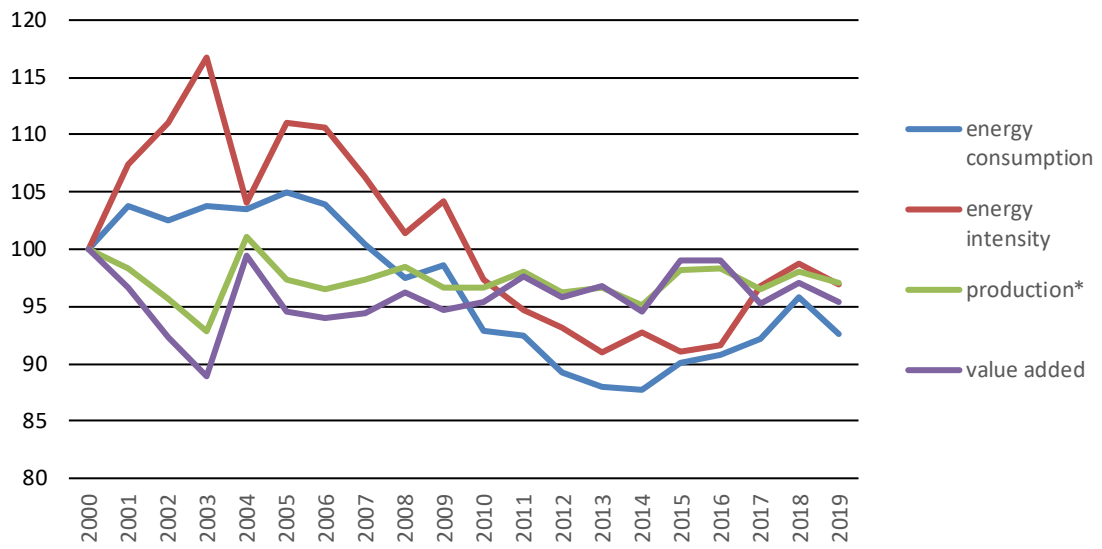


Source: ODYSSEE

The energy consumption of agriculture was decreasing in the years 2005-2014 and then grew, while the production and the added value of agriculture have been quite stable since 2008 (Figure 36).

Energy intensity decreased by 3% in the period 2000-2019 as the consequence of the trend in energy consumption.

Figure 36: Energy and economic components in agriculture (2000=100)



Source: ODYSSEE, \*ISTAT (Italian National Institute of Statistics)

## REFERENCES

- (1) National Recovery and Resilience Plan: <https://www.governo.it/sites/governo.it/files/PNRR.pdf>
- (2) National Energy Strategy 2017:  
[http://www.sviluppoeconomico.gov.it/images/stories/documenti/testo\\_della\\_StrategiaEnergeticaNazionale\\_2017.pdf](http://www.sviluppoeconomico.gov.it/images/stories/documenti/testo_della_StrategiaEnergeticaNazionale_2017.pdf)
- (3) Italian National Energy Efficiency Action Plan 2017:  
[https://ec.europa.eu/energy/sites/ener/files/documents/it\\_neeap\\_2017\\_en.pdf](https://ec.europa.eu/energy/sites/ener/files/documents/it_neeap_2017_en.pdf)
- (4) Italian Energy Efficiency Annual Report 2021, ENEA